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13. ABSTRACT (Maximum 200 words)  The sponsored research is aimed at supporting PI's U.S. graduate students at Boston University for thesis research in the area of ionospheric radio physics. The reported subjects include (1) comparison of TOPEX and Global Positioning System total electron content measurements at equatorial anomaly latitudes (published by J.A. Vladimer, M.C. Lee, P.H. Doherty, D.T. Decker, and D.N. Anderson, in Radio Science, Volume 32, Number 6, pp. 2209-2220, 1997) and (2) longitude structure of Ionospheric total electron content at low latitudes measured by the TOPEX/Poseidon Satellite (published by J.A. Vladimer, P. Jastrzebski, M.C. Lee, P.H. Doherty, D.T. Decker, and D.N. Anderson, in Radio Science, Volume 34, Number 5, pp. 1239-1260, 1999).					
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Final Report for Research Sponsored by AASERT Grant F49620-94-1-0365  
for the Period of July 1, 1994 – June 30, 1998  
Principal Investigator: Prof. Min-Chang Lee

The AASERT grant (F49620-94-1-0365) had been used to support the following U.S. graduate students: Kevin O'Donnell, Virginia Ewell, Piotr Jastrzebski, and Jane Vladimer for thesis research in the Department of Electrical and Computer Engineering at the Boston University. These students had acquired their Master degrees in Electrical Engineering. Piotr Jastrzebski passed Ph.D. qualifying examinations and became a Ph.D. candidate, after the AASERT grant expired.

Two journal articles reporting the sponsored research were published in American Geophysical Union's Radio Science. They are entitled

- (1) "Comparison of TOPEX and Global Positioning System Total Electron Content Measurements at Equatorial Anomaly Latitudes"  
By J.A. Vladimer, M.C. Lee, P.H. Doherty, D.T. Decker, and D.N. Anderson, Radio Science, Volume 32, Number 6, pp. 2209-2220, 1997, and
- (2) "Longitude Structure of Ionospheric Total Electron Content at Low Latitudes Measured by the TOPEX/Poseidon Satellite"  
By J.A. Vladimer, P. Jastrzebski, M.C. Lee, P.H. Doherty, D.T. Decker, and D.N. Anderson, Radio Science, Volume 34, Number 5, pp. 1239-1260, 1999, respectively.

As discussed in Vladimer et al. [1997], discrepancies exist between vertically measured ionospheric total electron content (TEC) and slant measurements of TEC that are converted to vertical with the use of a mapping function. Vertical measurements of TEC that are determined by the TOPEX altimeters are compared with equivalent vertical TEC values that are derived from the Global Positioning System (GPS) constellation at latitudes  $-40^{\circ}$  to  $+40^{\circ}$  and longitudes  $180^{\circ}$  to  $360^{\circ}$  during periods in 1993, 1994, and 1995. Also, comparison are made with the Philips Laboratory parameterized ionospheric model (PIM) predictions of vertical and equivalent vertical TEC from the same observation points. A trend of disagreement in maximum and minimum TEC values is observed between TOPEX and GPS passes that involve measurements within  $20^{\circ}$  to the south and to the north of the geomagnetic equator. PIM model predictions,

although not exact in value, are consistent in configuration with these observations of overestimation as well as underestimation of TEC. It is shown that the errors are dependent on not only elevation angle but also azimuth of the line-of-sight direction. The elevation mapping function that relates the line-of-sight TEC to vertical TEC and other assumptions that are made in the application of the ionosphere shell model may be contributing factors to the slant-to-vertical conversion errors.

In Vladimer et al [1999], the longitude structure of ionospheric total electron Content (TEC) at low latitudes has been evaluated using the NASA/Centre Nationale d'Etudes Spatiales TOPEX/Poseidon satellite. The TEC data set is given by the ionospheric range correction, which is computed from TOPEX dual-frequency altimeter measurements. The satellite's orbit allows analysis of vertically measured TEC values at approximately  $30^\circ$  intervals of longitude across the world at the local time difference of only 6-12 min. Patterns of longitudinal dependence of the equatorial anomaly were observed during the equinoxes, summers, and winters of 1993, 1994, and 1995. TOPEX observations reveal occurrence of relative maximum anomaly TEC values in the Indian/Asian longitude sector. This dominance in TEC is seen most consistently in the Asian Southern Hemisphere. Also, a relative decrease in anomaly TEC value is evident in the western American region, which is observed primarily during equinox and winter. This configuration of the equivalent anomaly TEC is observed on a day-to-day basis at particular periods of local time. Global theoretical ionospheric model results are presented in an attempt to reproduce the distinctive longitude structure. Variability in  $\mathbf{E} \times \mathbf{B}$  vertical drift velocity within specific longitude sectors is shown to be a primary factor in the longitude dependence of equatorial anomaly TEC.